

# [Li-fi technology essay sample](https://assignbuster.com/li-fi-technology-essay-sample/)

ABSTRACT

Whether you’re using wireless internet in a coffee shop, stealing it from the guy next door, or competing for bandwidth at a conference, you’ve probably gotten frustrated at the slow speeds you face when more than one device is tapped into the network. As more and more people and their many devices access wireless internet, clogged airwaves are going to make it increasingly difficult to latch onto a reliable signal. But radio waves are just one part of the spectrum that can carry our data. What if we could use other waves to surf the internet? One German physicist , DR. Harald Haas, has come up with a solution he calls “ Data Through Illumination”—taking the fiber out of fiber optics by sending data through an LED light bulb that varies in intensity faster than the human eye can follow.

It’s the same idea behind infrared remote controls, but far more powerful. Haas says his invention, which he calls D-Light, can produce data rates faster than 10 megabits per second, which is speedier than your average broadband connection. He envisions a future where data for laptops, smartphones, and tablets is transmitted through the light in a room. And security would be a snap—if you can’t see the light, you can’t access the data. Li-Fi is a VLC, visible light communication, technology developed by a team of scientists including Dr Gordon Povey, Prof. Harald Haas and Dr Mostafa Afgani at the University of Edinburgh.

The term Li-Fi was coined by Prof. Haas when he amazed people by streaming high-definition video from a standard LED lamp, at TED Global in July 2011. Li-Fi is now part of the Visible Light Communications (VLC) PAN IEEE 802. 15. 7 standard. “ Li-Fi is typically implemented using white LED light bulbs. These devices are normally used for illumination by applying a constant current through the LED. However, by fast and subtle variations of the current, the optical output can be made to vary at extremely high speeds. Unseen by the human eye, this variation is used to carry highspeed data,” says Dr Povey, , Product Manager of the University of Edinburgh’s Li-Fi Program ‘ D-Light Project’

1. INTRODUCTION

In simple terms, Li-Fi can be thought of as a light-based WiFi. That is, it uses light instead of radio waves to transmit information. And instead of Wi-Fi modems, Li-Fi would use transceiver-fitted LED lamps that can light a room as well as transmit and receive information. Since simple light bulbs are used, there can technically be any number of access points. This technology uses a part of the electromagnetic spectrum that is still not greatly utilized- The Visible Spectrum. Light is in fact very much part of our lives for millions and millions of years and does not have any major ill effect. Moreover there is 10, 000 times more space available much more.

The technology truly began during the 1990’s in countries like in this spectrum and just counting on the bulbs in use, it also multiplies to 10, 000 times more availability as an infrastructure, globally. It is possible to encode data in the light by varying the rate at which the LEDs flicker on and off to give different strings of 1s and 0s. The LED intensity is modulated so rapidly that human eyes cannot notice, so the output appears constant. More sophisticated techniques could dramatically increase VLC data rates.

Teams at the University of Oxford and the University of Edinburgh are focusing on parallel data transmission using arrays of LEDs, where each LED transmits a different data stream. Other groups are using mixtures of red, green and blue LEDs to alter the light’s frequency, with each frequency encoding a different data channel. Li-Fi, as it has been dubbed, has already achieved blisteringly high speeds in the lab. Researchers at the Heinrich Hertz Institute in Berlin, Germany, have reached data rates of over 500 megabytes per second using a standard white-light LED. Haas has set up a spin-off firm to sell a consumer VLC transmitter that is due for launch next year. It is capable of

2. HARALD HAAS AN SOME LI-FI 2 D ND HISTORY: H

Harald Haas con H ntinues to wow th world with th potential to he he use light for communication. LI-FI technol u c logy has the potential to change how we acce the internet, s p ess stream videos, receive emails a Germany, K and Korea, and Japa where they an discovered LED could be ret d D’s trofitted to send information. d This type of lig would come in familiar forms such as T ght fo in nfrared, ultravio olet, and visible light. While the project is e facing early chal f llenges such as finding ways to get devices to f receive data fro affixed ligh sources, Ha om ht arald Haas is confident the the technology has future prowess. c commun nication not only has the potenti to solve the p y ial problem of lack of spectrum space, but ca also enable novel k an applicat tion. The visibl light spectru is unused, it’s not le um regulate and can be used for comm ed, munication at ver high ry speeds.. .

5. W WHAT MAK A FIBR OPTIC KES RE CABL LE:

Typically, fiber optic cables are mad up of variou parts de us dependi ing on what ca able you want. To better unde erstand, imagine looking at a bu e ulls-eye, the oute most circle wo er ould be the cabl jacket or what you see on the outside of a fibe optic le t er cable. T core is wher the data is sen as light from o end The re nt one of the cable to another. One key import fact is that th light tant he is reflec cted off of mirro inside the cab which helps get the ors ble light w waves to its des stination. Light is turned on a and off rapidly translating to 1’s and 0’s that are receive and t ed interpre as data. eted

3. GENESI OF LI-FI 3 IS I:

Harald Haas, a professor at the University of Edinburgh who H p began his resea b arch in the fie in 2004, g eld gave a debut demonstration o what he call d of led a Li-Fi pro ototype at the TEDGlobal conf T ference in Edinb burgh on 12th J July 2011. He used a table lam with an LED bulb to transm a video of u mp D mit blooming flowers that was th b hen projected o onto a screen behind him. Duri the event he periodically blo b ing ocked the light from lamp to pr fr rove that the lam was indeed the source of mp in ncoming data. At TEDGlobal, H A Haas demonstrat a data rate ted of transmission of around 10Mb — comparab to a fairly o bps ble good UK broa g adband connection. Two mon nths later he achieved 123Mbp a ps.

Fig 1. Fibre optics 101:

4. HOW LI 4 I-FI WORK KS:

Li-Fi is typically implemented u L y using white LED light bulbs at D th downlink tran he nsmitter. These devices are norm mally used for il llumination only by applying a c y constant current. However, by fast and subtle va f ariations of the c current, the optical output can be made to vary at extremely hig speeds. This very property b gh of optical current is used in L o Li-Fi setup. Th operational he procedure is ver simple-, if th LED is on, y transmit a p ry he you digital 1, if it’s off you transmit a 0. The L d s LEDs can be switched on an off very quickly, which gives nice nd h opportunities for transmitting da Hence all th is required o r ata. hat is some LEDs an a controller th code data into those LEDs. s nd hat o All one has to do is to vary the ra at which the LED’s flicker A o ate depending upon the data we want to enc d n e code.

Further enhancements ca be made in th method, like using an array e an his u of LEDs for par o rallel data transm mission, or usin mixtures of ng red, green and blue LEDs to alt the light’s fr b ter requency with each frequency encoding a d e different data c channel. Such advancements p a promise a theor retical speed of 10 Gbps – f meaning one can download a fu high-definitio film in just m n ull on 30 seconds. 3 To further get a g T grasp of Li-Fi co onsider an IR remote. It sends a single data stre eam of bits at th rate of 10, 00 he 00-20, 000 bps. Now replace the IR LED with a Light Box cont N taining a large LED array. This system is capa L s able of sending thousands of such streams at v very fast rate Light is inherently safe and can be used in place where radio L es frequency comm fr munication is oft deemed prob ten blematic, such as in aircraft cabins or hospitals. So visible light a h

Fig 2. lly, fiber optic cables are wir that transm data res mit General through an extremely thin layer of gl h lass or plastic t threads. These th hreads are the a actual fibers in a fiber optic cab The ble. relationship to LI-FI t technology is in the regard th data n hat travels through the fiber in the form of light which is then ed d the translate into 1’s and 0’s, the data part. One of t key advanta ages to using lig as a data tra ght ansmitter is its m massive bandwid which is wh makes fiber optics popular today. dth hat r r Howeve fiber optics a notoriously e er, are expensive but ma soon ay replace most existing tra aditional metal c cables.

6. HA ARALD HA AAS’S RES SEARCH:

Harald Haas’s research seems to loo at Optical w h ok wireless nication. Generally, the best w to describe how a way commun typical LI-FI situation m L might work is LE light bulbs a ED attached to the ceiling of an area An individual with a wireless device a. s me gather and recei data ive and som kind of optical receiver can general wireless covera within build age dings, and li-fi i ideal is for high density wireless data coverag in confined ar and h ge rea for relie eving radio inter rference issues, s the two techn so nologies can be c considered comp plimentary.

Table 1 1. Comparison b between current and future w wireless Technol logy

Fig 4. F There are cer T rtain implicatio ons of Light transmission te echnology that are in use toda For exampl fiber optic ay. le, cables have com c mponents that in nvolve using lig to receive ght and send data through the w a wiring in fiber optic cables. Typically, fiber optic cables have three compone which are T o ents th core, claddi he ing and buffer coating. In a this early r all, im mplication of LI I-FI, is be used by many differe companies ent and areas of stud including med a dy dical areas, for i ease of use its and reliability co a ompared with oth alternatives. her

The tab also contains the current wir ble s reless technologies that can be used for transfe erring data betw ween devices tod day, i. e. Bluetooth and Ir rDA. Only Wi-F currently offe very Fi ers Wi-Fi, B high da rates. The IE ata EEE 802. 11. n in most implemen ntations provides up to 150Mbit/s (in theory t standard can go to the n 600Mbi it/s) although in practice you receive considerab less bly than thi Note that on out of three of these is   
an optical is. ne technolo ogy.

8. CO ONCLUSIO ON:

The pos ssibilities are nu umerous and can be explored fur n rther. If this tech hnology can be put into practic use, every bu can cal ulb be used something like a Wi-Fi hotspot to transmit w d e wireless data and we will proce toward the cleaner, greener, safer eed of urrently and brighter future. The concept o Li-Fi is cu ng t attractin a great deal of interest, not least because it may offer a genuine and ve efficient alte ery ernative to radio o-based s. ng p r wireless As a growin number of people and their many devices access wireless internet, the airwaves are bec s a coming increasi ingly clogged, m making it more an more difficul to get nd lt a reliab high-speed s ble, signal.

This ma solve issues s ay such as the sho ortage of radio-frequency band dwidth and also allow o internet where tradition radio based wireless isn’t a t nal allowed such as aircraft or hospi itals. One of the shortcomings h however t irect line of sigh ht. is that it only work in di Althoug our very ow Wi-Fi transm data through radio gh wn mits h waves which work o small fractio of electrom on on magnetic m. dth ced spectrum The bandwid is low and we all have fac this problem In college hostels, coffee shops the limited m. bandwid spoils our en dth ntire mood’ when the number of people f transmit tting data increases and our sp peed starts decr reasing.

7. DATA T 7 TRANSMISS SION VIA L LED LIGHTS: L

Harald Haas, a professor at the U H University of Endinburgh, was demonstrating tr d ransmission of data using LED lights. LED d D li ights, in general are more cost effective and ca l, apable of great speeds. Harald Haas has ach hieved speeds of about 10 megabits per sec m cond but hopes to increase that s speed to about 100 megabits per second. Using light as commun 1 r nication could also avoid proble found in reg a ems gular radio wave for instance es, communication would easier on oil rigs, underw c w water ventures, and airplanes w a where radio wa aves can cause all sorts of e problems. Klipsc a manufactur of speakers, had developed p ch, rer h speakers which could receive m music data sent through LED bulbs. b LI-FI is a term of one used to describe visible light L m communication technology app c plied to high sp peed wireless communication. It acquired this name due to the similarity to c e WI-FI, only usin light instead of radio . WI-F is great for W ng FI

Similarly 3G, where the system is getting increasingly congested thereby turning from a high speed transmitting data scheme to a silkworm speed accessing method. With this technology accessing or transmitting data in aircrafts, where radio waves could be a bit dangerous this technology will come into aid, it is of great use in underwater oil rigs where communication through radio waves is not possible. The interference level of this technology is low. It can lead up to speeds as high as 100 MB per second.

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Although this technology sounds like a replacement to Wi-Fi but this high speed data transferring technology also has some limitations that is the   
inability of light to pass through obstacles. It cannot pass through walls and can be blocked. If the light signal is blocked, we can seamlessly switch back over to radio waves (Wi-Fi).

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Now when we have to transmit data we got both light and radio waves to use accordingly as per the environment around us. The conclusion is that there is no dead end when it comes to technology, science always shows the path.

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